SUPPLEMENT TO
THE MEDICAL JOURNAL OF AUSTRALIA
Number 3, November 28, 1942

WAR MEDICINE AND SURGERY

Compiled under the direction of the Committee on the Survey of War Medicine of the National Health and Medical Research Council.

HOSPITAL ORGANIZATION FOR AIR RAIDS.

HOSPITAL authorities in places that are subject to air raids have found themselves confronted with five new problems: (*a*) the protection of the hospital itself; (*b*) the formulation of a plan to organize the staff on the receipt of an air-raid warning; (*c*) the care, during an air raid, of patients unable to be evacuated; (*d*) the reception and treatment of air-raid casualties; (*e*) the evacuation of some patients to safer areas or special clinics.

Protection of Hospitals.

It is not practicable to provide hospitals which will resist a direct hit by a high-explosive bomb, or even the blast from a bomb falling near by. The best that can be done is to localize the damage from high explosives falling more than about fifty feet away, and to protect the building from anti-aircraft fire and the smaller incendiary bombs.

This protection is so incomplete that its limitations in the case of a heavily bombed area must be clearly realized. In Coventry, the damage done to the two central hospitals was very extensive, and the patients from them had to be evacuated. This early evacuation to base hospitals is now accepted as the method of choice wherever centres such as Coventry remain exposed to air-raid risks. Towns with the local hospitals situated on the periphery are in a more favourable position, but, even in these cases, if the town is likely to be a favoured target, the local hospitals should act merely as casualty clearing stations.

The finding of new hospital accommodation, however, requires time and money. In only a few instances are such projects as the building of special underground operating theatres possible. In most cases the existing hospitals have to make whatever protective structural alterations they can, and carry on.

Competent builders should therefore be called in to reinforce and protect strategic parts of the building. The alterations required have been described in an Emergency Medical Services Memorandum,[3] and further discussed by two superintendents of Australian hospitals.[1][2] An emergency operating theatre is essential, and all unnecessary glass should be removed from existing theatres. Blackout is a special problem in hospitals because of the large number of windows and lights involved, and the fact that its requirements are somewhat inconsistent with healthy ventilation. It should be coupled with good sign-posting to avoid confusion to strangers; the best signs are in silver lettering on an ultramarine background, and are placed three to four feet from the ground.

There should be careful duplicate arrangements for cooking, sterilizing, heating and lighting. At least one important London hospital was rendered useless during a raid because its lighting failed. Moreover, large foreign bodies have frequently been missed in operations performed under emergency lighting; and therefore no trouble should be spared in order to ensure that the alternate lighting is not just a flickering makeshift. A proper battery lighting set is needed; torches are useful outside the theatres, but lamps are dangerous.

Protection against gas is not normally a matter of making structural alterations, but rather of using respirators. However, there will be infants and some adult patients who cannot use these, and an attempt should be made to provide them with a gas-proof refuge. Such a building requires air-locks at each end, and should include sanitary accommodation. Further buildings are needed in the event of vesicant gas warfare to act as a decontamination unit. This unit is not an elaborate structure, and can be readily improvised. It should be separate from the hospital buildings and be partitioned into three rooms—a receiving room, where the patient has his outer clothing removed and placed in a bin, a decontaminating room where the patient is cleansed, and a dressing room where the patient dons clean pyjamas and is warmed before a fire. The staff throughout wears protective clothing. All casualties contaminated by vesicant gas must pass through the unit, even though this prejudices the recovery of some who have wounds requiring urgent treatment.

So far, attention has been paid only to fixed buildings, but stores and equipment must also be considered. Extra quantities of important items, such as dressings, plaster of Paris, bandages and tinned foods, should be bought and held in reserve. Hospitals should have a list of the minimum essential material to be removed in case bombing makes it necessary to carry on in improvised buildings. The plans for speedy evacuation should be in the hands of a selected officer. He should have the equipment graded in priority and should have decided how much transport is required. In target areas it is useful to open a hospital unit outside the town. In many cases evacuation will not be necessary, but arrangements should nevertheless be made for it; otherwise chaos may result.

In all hospitals, equipment such as X-ray apparatus, blood bank stores, surgical instruments, dressings and important drugs should be divided and dispersed. Inflammable materials like films and ether should be kept in a concrete storeroom away from the main hospital. Emergency rations for twenty-four hours should be dispersed through the building. Arrangements should be made for the protection of hospital monies and records.

The precautions required to keep the supply of radium safe have occasioned much comment. One-millionth of a gramme is a lethal amount when fixed in the tissues of the body.[4] Therefore the complete destruction of a ward that had half a gramme of radium in use might liberate many thousand lethal doses. If radium is to be used normally without any precautions, it must be realized that, in the event of a direct hit, a large site would have to be carefully cleared of radium by a specially protected personnel, or else remain dangerous for all time.

It is generally agreed that the wholesale removal and storage of radium, such as was originally carried out in London, is unjustified. It exaggerates a definite but not undue risk at a time when gambling with life for the sake of saving other lives is rather common, and it deprives many patients of the benefits of radiotherapy.

The precautions listed so far are such as, having been once carried out, can be more or less forgotten. These are not the only measures to be taken; they are merely the easiest. A much more difficult proposition is the training of the staff to function as fire-fighters, bomb-spotters and rescue squads, and the organization of voluntary helpers for such work as traffic control, stretcher bearing, the messenger service and assistant nursing. In other words, this is the problem of the detailed allocation of personnel. The work cannot be arranged once and for all. It requires continual practice, inspiration and reorganization.

For some of this work the hospital engineer is a most important adviser. Amongst other duties, he attends especially to the steam, gas, electricity and water supplies. There must be adequate arrangements for turning these off if necessary.

When everything possible has been done to minimize the danger to hospital buildings, it is time to be reassured by a statement made by the Minister for Health in England during May, 1941. He denied that the hospitals had received an undue proportion of bombs, and stated that casualties amongst personnel had not been heavy; at that time three doctors had been killed and eight injured, amongst the medical staffs of four hundred London hospitals. To present a complete picture, however, one must add that many large teaching hospitals in London were so vulnerable that they were not used to their full extent, but acted mainly as dressing stations.

Organization of Staff on Receipt of an Air-Raid Warning.

An essential preliminary to organization for an air raid is to have a comprehensive plan drafted out; and this implies that the hospital has obtained from the hospital control a full account of what it is required to do in the event of an air raid. No hospital can function efficiently as an independent unit in work of this kind, and it is very important that every effort should be made to cooperate in the State-controlled plan. In general, there are in England casualty clearing hospitals and base hospitals. Many of the latter contain specialized units; all of them have satellite hospitals or buildings for use as convalescent homes. In a sparsely populated country such as Australia, this clear-cut distinction will not be so evident. Only in the larger cities will any great division of labour be possible; even there, only the logic of unfavourable experience is likely to lead to evacuation of large hospitals; and such evacuation, if required, may have to be largely improvised. The following description of the work in a hospital receiving air-raid casualties therefore has a fairly wide application.

When the warning comes, the switch operator should call at once the superintendent, the matron and the secretary, or, in their absence, the respective deputies. The matron and secretary should see to the organization of their staffs. In the case of a hospital which is to receive casualties, the superintendent should go to the control room and arrange for telephone communication with the outside staff. These people will have been given passes and windscreen stickers, issued by the National Emergency Service. They can therefore proceed to the hospital at once if necessary; but the superintendent should take an objective view of the situation, balance the danger of their reporting during an air raid against the needs of the hospital, and not create chaos by calling out people for whom there is no urgent work.

Many members of the staff have definite jobs; others will have to be told what to do by the superintendent when they report. The completed staff consists of:[1][2][3] (*a*) the superintendent; (*b*) the admitting officer; (*c*) a senior member of the surgical staff to make the diagnoses and determine the order of operation; (*d*) a physician to control the resuscitation ward and to assist the senior surgeon in the diagnosis of thoracic and neurological cases; (*e*) surgical teams sufficient for the available tables (these men have to be replaced from time to time if the pressure of work becomes too great); (*f*) anæsthetists, of whom one is of senior standing; (*g*) radiologist; (*h*) resident medical officers (some are attached to the wards to carry out the instructions of the surgeons, some assist at operations and in the resuscitation ward, some attend the minor casualties and some carry on with the indispensable hospital routine); (*i*) the nursing staff (extra nurses must be obtained to reinforce the matron's usual staff of sisters, nurses and voluntary aids, for if a raid occurs at night, the staff required will be even greater than the normal day staff, especially in the operating theatres); (*j*) the lay staff, consisting of engineers, domestics, porters, stretcher bearers, fire-watchers, almoners and clerks.

The key man from the point of view of organization is the superintendent. Having summoned the staff and seen that each essential post has been filled, he should tour the wards. He should reassure and encourage both nursing staff and patients, and look into any reported incident or difficulty. He should make the necessary decisions about such things as evacuating a damaged ward, or calling up extra personnel for fire-fighting, or obtaining help to relieve the operating staff. He should watch the rate of admission of patients, and arrange for the diversion of ambulances to other hospitals when his own becomes full. He constitutes a higher authority to whom the matron and engineer report progress, and from whom they seek advice on general matters.

The superintendent is greatly assisted by an efficient messenger service. This is supplied by voluntary workers such as Scouts, and is an indispensable precaution against the breaking down of telephone communications. Ambulances pursuing their normal duties can also be used for the interchange of messages between a hospital and the control centre, first-aid post or other hospitals. Ambulance drivers who have not an accurate knowledge of alternate routes may sometimes be greatly helped if the hospital supplies a guide.

All personnel working at the hospital during an air raid should be able to obtain hot food and drink at any hour, so that the kitchen staff must maintain this service throughout night and day.

Care of Patients Unable to be Evacuated.

The patients in hospital at the time of the raid can be divided into those who are ambulatory and those who are confined to bed.

The ambulatory patients are taken by a nurse to protected areas. This can be done all the more quickly if a dressing gown, slippers and a blanket are kept in readiness. The protected areas should be fairly blast-proof and splinter-proof, and not exposed to risk from the bursting of gas, water, steam or sewerage pipes. The shelter should be subdivided and have several exits. It is desirable to have beds set up for children, who then need not be disturbed when the "all clear" sounds. Slit trenches provide a poor substitute for shelters, but may sometimes have to be used. Nurses are attached to various groups of sheltering patients.

The patients confined to bed can be given protection from secondary missiles such as glass in a simple way. No beds are allowed beneath windows. A heart table is drawn up to the level of the patient's waist and a cradle put over the head and shoulders. A mattress is then thrown over the cradle and table, and allowed to hang over the head of the bed. The patient is thereby protected without being made to feel suffocated, and the nurse is able to see the patient's face quite well. The confinement is not uncomfortable and patients may sleep throughout the raid.

The covering-up of the patients confined to bed is done by the nurses, who report to their respective wards when the alarm is given. After the work is completed the nurses go to bed in the hospital rather than return to and crowd their home. Every effort should be made to see that the nurses have sufficient sleep; otherwise there is a quick loss of efficiency.

The resident medical officers help to cover the patients who are confined to bed. They then visit the patients whom the nurses have taken to the shelters, and they finally go to bed in the particular block of the hospital in which they work.

Reception and Treatment of Air-Raid Casualties.

The organization of a receiving hospital is influenced by the following figures which Ryle has given for "the rough working out of cases in most places":[33] (*a*) Twenty-five *per centum* are in a state of shock, or have severe injuries likely to lead to shock; these go to the resuscitation ward; some of them will recover there with only simple measures, but it is best to err on the side of sending too many for resuscitation. (*b*) Twenty-five *per centum* are less severely wounded, but require in-patient treatment, usually an operation; these go to a surgical ward. (*c*) Fifty *per centum* have minor injuries suitable for out-patient treatment; after examination, these patients are given their treatment, and sent for a time to a rest room.

Many hospitals have found it convenient to make special provision for eye casualties in an ophthalmic service room. This room has a suitable table with good lighting facilities and the special equipment required for the diagnosis and treatment of eye injuries. Patients treated there are either sent home or admitted to hospital. Patients with wounds that are more urgent than their eye injury do not go to the ophthalmic unit, but are examined by the ophthalmic surgeon either in the operating theatre or the ward.

If the above subdivision into three or four classes is followed, there is no need for labels. The average doctor does not find a system of coloured labels very helpful.

Admission to Hospital.

A large ward, divided into two parts, one for each sex, makes a suitable reception room. It should be in an accessible spot, supplied preferably by a one-way-traffic route, and of easy access to the various wards. It must be on ground level so that the failure of the lift will not disorganize the admission of casualties.

The room should be well blacked-out, and have good lighting and emergency lighting. Hot drinks should be available and radiant heat and hot water bottles provided, so that simple measures of resuscitation from shock can begin at once.

When the ambulance arrives, the patients should be taken into the room without being moved from their stretchers, and the stretchers placed on rows of trestles. There should be stacks of identical stretchers, blankets, hot water bottles and Thomas splints from which replacements can be taken by the ambulance driver. The replacements are checked by a clerk. The ambulance men have probably been under some strain and are given refreshments while their casualties are being unloaded.

This mass handling of the casualties is necessary because of the large numbers. The usual hospital admission department is quite inadequate, and as Mitchiner and Gowell remark,[39] one requires "organized reception, not haphazard saturation". Practically all casualties, apart from those trapped by debris, reach the hospital within one to three hours.

The admitting officer must not necessarily be a man of special training, but requires common sense and average clinical judgement. He is helped by a sister, a nurse, a member of the clerical staff, and stretcher bearers. The equipment must include a small sterilizer, syringes, morphine and anti-tetanus serum.

The casualties are dealt with at the rate of about ten minutes per ambulance load of four. The clerk takes a record of the name, address, age, sex, religion and nearest relative. Some of this information should be found on the casualty card, if the patient has been through a first-aid post. No time is wasted in taking these particulars from a patient who is obviously shocked. Such casualties are sent straight to the resuscitation ward and the particulars about them are obtained later. The sister gives every patient admitted two thousand units of anti-tetanus serum.

The admitting officer makes a brief examination. The decision he has to arrive at is whether special resuscitation is required or not. He therefore does not turn the patient over or determine accurately the nature of the wounds, or try to decide whether operation is required. He should aim at assessing the sum total effect of the injury on the patient, without investigating fully the nature of the injury.

The patients are examined in strict rotation with the exception that earliest attention is given to those with tourniquets, those with sucking wounds of the chest and those in great pain. There is a tendency to apply tourniquets unnecessarily, and the sooner they are removed, the less likelihood there is of damage to nerves, of infection or of gangrene. It would be a tragedy to have to amputate a limb because a tourniquet had been neglected by the admitting officer. The tourniquet can usually be removed without restarting the hæmorrhage, but if bleeding does occur, it is all the more desirable that the patient should be attended to early. Casualties with sucking chest wounds must have sutures inserted at once, while patients in severe pain need morphine.

As each patient is examined, a clerk records the findings. The patients are then dispatched to the various sections of the hospital: those on stretchers go to the resuscitation ward or the surgical ward; about 5% to 10% of the walking wounded may become "stretcher cases" after admission[39] and follow this course, but the majority go to the ophthalmological unit, the out-patients' department, or the rest room; the moribund are sent to a "silence" ward; any casualties found dead in the ambulance are sent to the mortuary.

The system of recording should be such that full statistics are available at any moment.[39] The head clerk should keep details showing the number of occupied and of vacant beds in all wards. He should therefore keep in touch with the admitting room to find out where the patients are sent. He should also be notified if a patient changes wards or goes to the operating theatre. These statistics regarding admissions should be carefully taken, as they may become the basis of useful research. Every effort consistent with reasonable speed of working should be made by the recording staff to identify all casualties.

The Resuscitation Ward.

It has been found that it is essential to have one ward set aside as a resuscitation ward.[39] If this is not done, there is a danger that a shocked patient sent to a busy general ward may be overlooked, while minor injuries are being attended to. Moreover, the work of resuscitation is best carried out by specially trained personnel consisting of a physician who is in charge, a resident medical officer specially trained in blood transfusion, and nurses; and they cannot work efficiently if they have to move from ward to ward. Further, all necessary apparatus can readily be collected into one ward and be immediately available. Shock is especially common in air-raid casualties, possibly owing to the multiple trauma and the increased psychological effects,[39] and the treatment has to be organized on a comprehensive basis.

Some small hospitals have made a compromise in that the reception room is also the resuscitation room. This has the advantage of saving some patients an extra move from the admitting room to the resuscitation ward. The essential requirements of the resuscitation ward are that there should be sufficient space and that the place selected should be safe and quiet.

The ward used is preferably one at the end of a corridor and near to a blood bank and sterilization room. There is no need to have separate rooms for the two sexes.

An important feature of the resuscitation work is the continual observation of the patient as his condition changes for better or worse. The longer a patient remains in a state of shock, the less are his chances of recovery, and one likes to see a definite improvement within half an hour of the commencement of treatment. Serial half-hourly records should be kept showing the blood pressure, pulse rate, hæmoglobin value, vomiting and blood loss.

Decision About Operation.

The important task of diagnosis and of deciding the priority of operations is left to one man. He should be a surgeon of senior consultant rank, but not necessarily a member of the regular hospital staff. He does not usually

operate himself, because his other work is more important; but he may operate when cases are few, or failing that, he may sometimes give advice in the theatre. It is, of course, a disadvantage that the operating surgeon does not always see the patients beforehand. To compensate partly for this, it is essential that full and accurate records should go with the patients to the operating theatre. In some instances it may be possible for the operating surgeon to have an actual consultation with the senior surgeon.

The senior surgeon examines the patients in the resuscitation ward after anti-shock treatment has been commenced, and assesses the degree of injury in each case. He makes a systematic round, dictating a statement about each patient. Any radiographs he requires should be taken in the ward with a portable machine. He allots the patients to the surgeons according to the skill of the latter, and is responsible for the order of the operation list. He does the same work in the case of patients admitted directly to the wards. The provisional operation list may need revision from time to time, and he therefore constantly reviews the condition of the patients. It will be obvious that his work and the subsequent work of others will be much easier if all the air-raid casualties are admitted to specially reserved wards.

The problems arise as to the stage at which a patient should be undressed, and when it is safe to lift him from the stretcher on which he arrives. These matters are decided in each individual case by the senior surgeon, who is responsible for seeing that every inch of skin is examined. In these days of clothes rationing, tailors' shears are needed for opening up seams without mutilating the garment. It is also suggested that the hospital should provide two bags for each patient, a large one for his clothes, and a small one for his jewellery and valuables.

The senior surgeon may prescribe any necessary immediate treatment, such as the administration of morphine, the removal of a tourniquet or the splinting of a loose fracture.

Organization for Operations.

All available operating theatres must be kept ready for use, because a batch of patients is likely to reach the optimal stage for operation at the one time. The peace-time priority arrangements amongst the surgeons are upset and this makes it essential to have one man in charge. The senior surgeon assumes this responsibility by drawing up the operation list.

It has been found convenient in many places to clean the patient in a room adjoining the theatre before the operation begins. Sometimes anæsthesia is needed for this. Regarding the filthy condition of air-raid casualties, an English surgeon writes:[9]

> Only those who have had to deal with victims of air raids can conceive the appalling condition and appearance of many of these patients on their arrival in hospital. . . . A sight which must be seen to be appreciated fully is the almost indescribably filthy condition of many who had evidently been clean and well clad.

The following figures show the operations performed on over one hundred patients during four months of air-raid surgery at one particular hospital:[10] orthopædic, 47%; excision and *débridement*, including burns, 46%; abdominal perforations, 4%; head surgery, depressions or penetrations, 2%; chest wounds, 1%.

The figures are obviously incomplete. Probably patients with special conditions such as eye injuries and facio-maxillary wounds had gone to special units, and, in any case, the number quoted is small. But the figures do emphasize how much of the work comes under the first two headings. By building up a sound routine for these operations, the surgical teams of even small hospitals can make a major contribution. The frequency of orthopædic operations necessitates adequate provision of plaster and splints.

Careful notes must be taken of all operative procedures and findings, because many of the patients will have to be evacuated later on to safer hospitals.

A hospital may become somewhat disorganized by pressure of work. In such cases, a relief surgical team may be asked for. This possibility has to be foreseen, and special arrangements made to receive the visiting surgeons. Moreover, it is useless to have fresh operators if they have to work in a strange hospital with a tired staff.

Organization of Post-Operative Treatment.

The senior surgeon and the physician in charge of the resuscitation ward continue to watch patients after operation. This continuity is important, as the operating surgeons cannot return to the wards from time to time to watch the progress of patients.

On the morning after the raid the senior surgeon assists his colleagues in the selection of patients for evacuation. Early evacuation to safe and peaceful areas is often important; many patients not evacuated are nervous and sleepless.

Evacuation

In the event of an unexpected air raid many hospitals will be found with patients who could be sent to their homes or to convalescent depots without greatly prejudicing their progress. These patients should be known so that they can be moved rapidly.

In the event of damage to the hospital, or even of threatened damage, as from a time-bomb, it may be necessary to have a wholesale evacuation.

During the normal routine of air-raid casualty work, there are a number of patients with special injuries who have to be evacuated to hospitals where they can receive the required treatment.

Information Service.

Within the hospital there should be some trained worker such as an almoner who finds out from the local authorities whether patients' homes are still standing. Many of the patients can be discharged quickly if they have homes to go to; but otherwise they must be sheltered at the hospital until the local authority can make provision for them.

A further information service should be established for the city as a whole by some responsible agency. Information regarding patients is transmitted to this central control from all the individual hospitals. Relatives therefore do not have to telephone large numbers of hospitals to inquire about their families. This central control can be expanded in an emergency by coopting people such as librarians who are used to filing information and dealing with the public.

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